



UNIVERSITY OF
TECHNOLOGY SYDNEY

Improving Knowledge Management in Construction Industry by Combining Ontology with Collaborative Technologies

Student Name Dongbai Xue

Supervised by Dr. Cynthia Wang

Prof. Igor Hawryszkiewicz

Faculty of Design, Architecture & Building

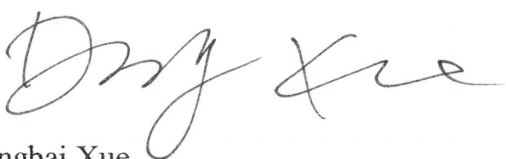
University of Technology, Sydney

July 2011

CERTIFICATE OF AUTHORSHIP/ORIGINNALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.


Dongbai Xue

Acknowledgements

First of all, I would like to express my sincere gratitude to my supervisor Dr. Cynthia Wang and Professor Igor Hawryszkiewicz, I thank them for giving me the opportunity to do this research and guiding me to finish this thesis.

Secondly, I would like to thank the Faculty of Design Architecture and Building and the Faculty of IT, UTS for providing me the research environment and facilities while I study, without their support this thesis cannot be presented.

In addition, I would thank my family for their encouragement and support during the whole course of my study at UTS. Finally, I would like to thank all my friends and classmates who helped me and shared their knowledge and experiences with me whenever I needed.

Abstract

The concept of knowledge management has been introduced to the construction industry for many years. Recently, its importance is more recognized as modern construction projects are more complex and globalized. Managing knowledge assets is a challenge, especially in the construction industry, as it is characterized as a project-based business which delivers one-of-a-kind product, and it has a highly fragmented working environment.

While explicit knowledge has been handled by many existing commercial project information management systems, tacit knowledge is more difficult to handle because of its intangible nature, and so far very few computer systems have attempted to handle tacit knowledge. Tacit knowledge is usually created and transferred in a social environment, and maintained mainly in human's head. Therefore a combination of a group of advanced IT technologies should be adopted for efficient knowledge manipulating. In this research, web-based collaborative system, blogging technology, domain ontology and semantic web environment are used together to provide technology support for knowledge management. The original contribution of this research is that it demonstrates the effectiveness of using construction domain ontology in semantic blogging to promote knowledge sharing.

While focusing on technology support, this research also investigates appropriate KM framework and system architecture for small and medium sized construction organizations. A prototype knowledge management system is proposed and implemented; some knowledge management cases are presented to demonstrate how the proposed KM framework and advanced IT tools could help the KM process in the construction industry.

Table of Content

- Acknowledgements 3
- Abstract 4
- Table of Content 5
- Chapter 1 Introduction 7
 - 1.1 Scope 7
 - 1.2 Objective of This Research 9
 - 1.3 Layout 10
- Chapter 2 Literature Review 11
 - 2.1 Knowledge and KM 11
 - 2.1.1 Multi-Faceted Nature of Knowledge 11
 - 2.1.2 Knowledge Forms 12
 - 2.1.3 Organizational Knowledge 13
 - 2.1.4 Knowledge Management 15
 - 2.1.5 Organizational Knowledge Management 15
 - 2.1.6 Project Knowledge Management 16
 - 2.2 KM in Construction Industry 18
 - 2.3 KM and IT 20
 - 2.3.1 Role of IT in KM 20
 - 2.3.2 Existing IT Used for KM in Construction Industry 21
 - 2.4 Challenges of Applying KM in Construction Industry 23
- Chapter 3 Research Methodology 26
 - 3.1 Introduction 26
 - 3.2 Design Science Research 27
- Chapter 4 Computer-supported KM Framework 29
 - 4.1 Introduction 29
 - 4.2 The Design of KM Framework 31
 - 4.2.1 The Generic KM Model 31
 - 4.2.2 Organization-based and User-Centric System Structure 33
 - 4.2.3 The Hierarchy of IT-based KMS 34
 - 4.3 KM Strategy 37
 - 4.4 The Potential User of the Proposed KMS 38
- Chapter 5 Ontology and Semantic Blogging Technology 40

5.1 Conventional Blogging	40
5.2 Semantic Web	43
5.3 Ontology	44
5.4 Semantic Web Based KM.....	45
5.5 KM Using Semantic Blogging.....	46
5.5.1 The Structure of Semantic Blogging.....	46
5.5.2 Annotation.....	47
5.5.3 Semantic Inference.....	49
5.5.4 Other Features of the Semantic Blogging.....	51
Chapter 6 Implementation of the Proposed KMS	52
6.1 Collaboration Functions in LiveNet.....	52
6.1.1 LiveNet Meta-model	53
6.1.2 Using LiveNet for KM.....	54
6.1.3 Lessons Learned from Past Projects	56
6.1.4 Brainstorm in Discussion Forum	57
6.1.5 Multiple Ways to Group People Together	58
6.1.6 Find and Talk to an Expert.....	61
6.2 Using Semantic Blogging in Construction Projects.....	62
6.2.1 Blog and Projects	62
6.2.2 Ontology Based Annotation.....	64
6.3 Case Study	65
6.3.1 Examples of Blog Entry	65
6.3.2 Ontology Based Knowledge Retrieving	69
6.3.3 Conclusions of the Case Study	74
Chapter 7 Conclusions	75
References	77
Appendix.....	83
Part of the e-Cognos Taxonomy Hierarchy	83